

REMARKS

Summary

Claims 1-2 and 17 were pending. Claim 1 has been rewritten, Claims 18-19 added and Claim 2 cancelled. No new matter has been added as a result of this amendment.

In the Amendment submitted December 23, 2003, Applicants inadvertently indicated that Claims 4-12 were cancelled. Applicants respectfully submit that the status of Claims 4-12 should have been indicated as withdrawn rather than cancelled and, if necessary, request reinstatement of these claims to withdrawn status. As a result, after entry of this amendment, Claims 1 and 17-19 are pending and Claims 4-12 remain withdrawn.

Rejection of Claims 1 and 2 under Mueller *et al.* under §102(e)

In the Advisory Action, Claims 1 and 2 stand rejected under 35 U.S.C. §102(e) as being anticipated by Mueller *et al.* Applicants have amended Claim 1, cancelled Claim 2 and respectfully traverse Examiner's rejection.

Amended Claim 1 recites an etching agent for etching copper at an approximately uniform rate throughout an etching process in an aqueous solution consisting essentially of potassium hydrogen peroxomonosulfate and acetic acid. The etching agent has a concentration of potassium hydrogen peroxomonosulfate ranging between 10.01% to about 23.31% by weight of the etching agent. Moreover, the etching agent is consisting essentially of the potassium hydrogen peroxomonosulfate and the acetic acid. An advantage of this etching agent is the uniform etch rate on copper that is provided. Here the potassium hydrogen peroxomonosulfate acts as the etching agent. The acetic acid "wets" the copper to assist in the etching.

Mueller, on the other hand, discloses a slurry used in a chemical-mechanical polishing ("CMP") process that includes an oxidizing agent, a catalyst and an abrasive material. Mueller describes the oxidizing agent as a monopersulfate. If the abrasive material is not included in the slurry, then an abrasive pad is used for polishing the

wafer. See Mueller at col. 4 ll. 26-28. If the abrasive material includes a metal oxide, Mueller teaches that an additive such as acetic acid might be useful to stabilize the oxidizer in the presence of the metal complex in the abrasive material. See, Mueller at col. 7 ll. 43-47.

Mueller teaches that the catalyst and abrasive are necessary components for the slurry and speed the CMP process. CMP is a process that planarizes wafer surfaces that become uneven during a process so that additional layers may be deposited on the wafer in a planarized fashion. It is the action of the abrasive in combination with the oxidizer and the catalyst that controls the removal of material. See, Mueller at col. 4 ll. 26-30. Neither component is included in an etching agent that is used to perform a uniform etch of copper, nor is either component recited in Claim 1.

In addition, despite the Examiner's insistence that Mueller's slurry is a polish/etch, Mueller teaches a slurry for CMP rather than an etching agent. Mueller's slurry is substantially different than the etching agent recited in Claim 1. The slurry of Mueller, as compared to the etching agent recited in Claim 1, works in a substantially different manner, and more importantly, gives a substantially different result. This is precisely because of the combination of elements present in Mueller's slurry. That combination is substantially different from the etching agent recited in Claim 1. The etching agent recited in Claim 1 specifically etches copper at a uniform rate. Mueller's slurry, in contrast, contains the catalyst and the necessary abrasive to flatten and smooth various layers (which may be of different materials) on the wafer during the CMP process. Since Mueller generally teaches the flattening and smoothing of multiple layers with the disclosed slurry, then explicitly, Mueller does not teach or anticipate an etching agent for copper that etches at an approximately uniform rate throughout the etching process. In other words, Mueller does not anticipate or teach, explicitly or impliedly, that the disclosed slurry is an etching agent for copper. For at least these reasons, the arrangements of Claims 1 and 17 are patentable over Mueller.

Rejection of Claims 1 and 2 under *Condra et al.* under §103(a)

In the Advisory Action, Claims 1 and 2 stand rejected under 35 U.S.C. §103(a) as being anticipated by *Condra et al.* in view of *Kubotera et al.* Applicants have amended Claim 1, cancelled Claim 2 and respectfully traverse Examiner's rejection.

Examiner states that *Condra* makes obvious the arrangement of Claim 1. The etching agents disclosed by *Condra* are: hydrochloric acid and ferric chloride; sulfuric acid in solution with cupric ions; and a combination of sulfuric acid and potassium dichromate. See *Condra* at col. 8 ll. 3-4, 22-23, 40-41. These "cleaning" agents consume tens of thousands of nanometers (or thousands of micro-inches) of copper per minute in an uncontrollable manner. Since *Condra* uses the peroxygen compounds as a rejuvenating material, it would not be obvious that such a compound could be used alone or in combination with acetic acid, a wetting agent, as an etching agent.

The etching agent recited in Claim 1 consists essentially of acetic acid and potassium hydrogen peroxomonosulfate. The potassium hydrogen peroxomonosulfate is used as the etching agent. The acetic acid is totally unlike the etching agents disclosed by *Condra* at least because there is no metal salt in combination with the acetic acid. Further, one advantage of the acetic acid is that it wets the copper so that there is an even etching action. There is nothing within *Condra* (or *Kubotera*) to suggest that acetic acid might be used.

For at least these reasons, neither *Condra* nor *Kubotera*, alone or in combination, anticipates or suggests the arrangements of Claims 1 and 17.

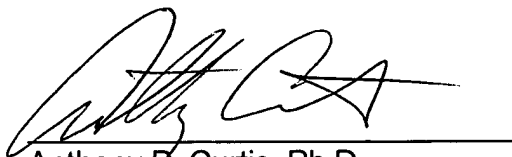
Addition of New Claims 18 and 19

New Claims 18 and 19 are patentable over the cited references for similar reasons as those provided above. No new subject matter has been added.

Conclusion

In view of the amendments and arguments above, Applicants respectfully submit that all of the pending claims are in condition for allowance and seek an early allowance thereof. If for any reason the Examiner is unable to allow the application in the next Office Action and believes that a telephone interview would be helpful to resolve any remaining issues, he is respectfully requested to contact the undersigned.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Anthony P. Curtis', is written over a horizontal line.

Anthony P. Curtis, Ph.D.
Registration No. 46,193
Agent for Applicants

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200